IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application

Applicant(s): Sarraf et al.
Case: 20-12
Serial No.: 09/396,055
Filing Date: September 15, 1999
Group: 2685
Examiner: Charles Chiang Chow

I hereby certify that this paper is being deposited on this date with the U.S. Postal Service as first class mail addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450
Signature: Date: September 14, 2004

Title: Method and Apparatus for Frequency Offset Estimation and Interleaver Synchronization Using Periodic Signature Sequences

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TRANSMITTAL OF APPEAL BRIEF

Mail Stop Appeal Brief Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Submitted herewith are the following documents relating to the above-identified patent application:

(1) Appeal Brief (original and two copies); and

(2) Copy of Notice of Appeal, filed on September 14, 2004, with copy of stamped return postcard indicating receipt of Notice by PTO on September 17, 2004.

There is an additional fee of $340 due in conjunction with this submission under 37 CFR §1.17(c). Please charge **Deposit Account No. 50-0762** the amount of $340, to cover this fee. In the event of non-payment or improper payment of a required fee, the Commissioner is authorized to charge or to credit **Deposit Account No. 50-0762** as required to correct the error. A duplicate copy of this letter and two copies of the Appeal Brief are enclosed.

Respectfully,

Date: November 17, 2004

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Signature: Linda Shelton Date: November 17, 2004

Title: Method and Apparatus for Frequency Offset Estimation and Interleaver Synchronization Using Periodic Signature Sequences

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APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Applicants hereby appeal the final rejection dated July 14, 2004, of claims 1 through 30 of the above-identified patent application.

REAL PARTY IN INTEREST

The present application is assigned to Lucent Technologies Inc., as evidenced by an assignment recorded on September 15, 1999 in the United States Patent and Trademark Office at Reel 010252, Frame 0914. The assignee, Lucent Technologies Inc., is the real party in interest.

RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

11/23/2004 HGUTEMA1 00000032 500762 09396055
01 FC:2402 170.00 DA

11/23/2004 HGUTEMA1 00000040 500762 09396055
01 FC:1402 340.00 DA

STATUS OF CLAIMS

Claims 1 through 30 are pending in the above-identified patent application. Claims 1, 12, 22, and 29-30 remain rejected under 35 U.S.C. §102(e) as being anticipated by Kleider et al. (United States Patent Number 6,487,252 B1), claims 2-10, 13-20, and 23-27 remain rejected under 35 U.S.C. §103(a) as being unpatentable over Kleider et al. in view of Rakib et al. (United States Patent Number 6,307,868) and claims 11, 21, and 28 remain rejected under 35 U.S.C. §103(a) as being unpatentable over Kleider et al. in view of Van Nee (United States Patent Number 6,404,732).

STATUS OF AMENDMENTS

There have been no amendments filed subsequent to the final rejection.

SUMMARY OF INVENTION

The present invention is directed to techniques for estimating the frequency offset and interleaver synchronization in an OFDM communication system. Certain locations in an OFDM frame, such as adjacent bins, are allocated to a signature sequence. (Page 5, lines 9-17.) Data is differentially encoded in frequency, so that said frequency offset and interleaver synchronization can be estimated from a single OFDM frame. (Page 5, line 18, to page 6, line 5.) The frequency offset is estimated at a receiver by determining whether a correlated peak associated with said signature sequence is in an expected location. (Page 7, line 17, to page 9, line 10.) A beginning of an interleaver block is identified based on a location of a correlated peak associated with the signature sequence. (Page 5, lines 18-24.)

ISSUES PRESENTED FOR REVIEW

i. Whether claims 1, 12, 22, and 29-30 are properly rejected under 35 U.S.C. §102(e) as being anticipated by Kleider et al.;

ii. Whether claims 2-10, 13-20, and 23-27 are properly rejected under 35 U.S.C. §103(a) as being unpatentable over Kleider et al. in view of Rakib et al.; and

iii. Whether claims 11, 21, and 28 are properly rejected under 35 U.S.C. §103(a) as being unpatentable over Kleider et al. in view of Van Nee.

GROUPING OF CLAIMS

The rejected claims stand and fall together.

ARGUMENT

Independent claims 1, 12, 22, 29, and 30 are rejected under 35 U.S.C. §102(e) as being anticipated by Kleider et al.

The Examiner asserts that Kleider teaches the "differential encoding in frequency 24" (Fig. 1; col. 4, lines 11-33).

Contrary to the Examiner's assertion, Applicants note that Kleider teaches that the differential encoding is performed in the time domain. Kleider teaches that "polyphase filter 16 performs an *inverse FFT* on the combined pilot sequence and symbol data as assigned to frequency bins provided from the modulator 14 and pilot sequence generator 18." (Col. 4, lines 8-11.) Thus, the output of the inverse FFT block (polyphase filter 16) is a signal in the *time domain* that is then differentially encoded by block 24. A multi-phase formatting is then performed by block 22 and, finally, the OFDM modulation is performed by transmit elements 26, which includes an upconverter and one or more RF amplifiers and filters (col. 3, lines 6-15). Similarly, block 32 differentially decodes the received signal in the time domain, and reverse poly-phase filter 38 performs a FFT to convert the resulting signal into the frequency domain. Independent claims 1 and 22 require "transmitting said signature sequence with data to a receiver, wherein said data and signature sequence are encoded using a differential encoding performed in frequency" and independent claims 12, 29 and 30 require wherein said received digital signal (that contains a signature sequence in an expected location) is encoded using a differential encoding performed in frequency. Both the *data and the signature sequence* are encoded using a differential encoding performed in frequency.

Thus, Kleider et al. do not disclose or suggest "transmitting said signature sequence with data to a receiver, wherein said data and signature sequence are encoded using

a differential encoding performed in frequency," as required by independent claims 1 and 22, and do not disclose or suggest wherein said received digital signal (that contains a signature sequence in an expected location) is encoded using a differential encoding performed in frequency, as required by independent claims 12, 29 and 30.

Additional Cited References

Rakib et al. has been cited by the Examiner for its disclosure of the details of an interleaver. Rakib does not disclose or suggest techniques for estimating the frequency offset or interleaver synchronization in an OFDM communication system, using differential decoding in frequency.

Van Nee has been cited by the Examiner for its disclosure of a digital modulation system that provides enhanced multipath performance using modified orthogonal codes. Van Nee does not disclose or suggest techniques for estimating the frequency offset or interleaver synchronization in an OFDM communication system, using differential decoding in frequency.

Conclusion

Thus, Kleider et al., Rakib et al., and Van Nee, alone or in any combination, do not disclose or suggest "transmitting said signature sequence with data to a receiver, wherein said data and signature sequence are encoded using a differential encoding performed in frequency," as required by independent claims 1 and 22, and do not disclose or suggest wherein said received digital signal (that contains a signature sequence in an expected location) is encoded using a differential encoding performed in frequency, as required by independent claims 12, 29 and 30.

The rejections of the independent claims under §102 and §103 in view of Kleider et al., Rakib et al., and Van Nee, alone or in any combination, are therefore believed to be improper and should be withdrawn.

The remaining rejected dependent claims are believed allowable for at least the reasons identified above with respect to the independent claims.

The attention of the Examiner and the Appeal Board to this matter is appreciated.

Respectfully,

Date: November 17, 2004

Kevin M. Mason
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APPENDIX

1. A method for estimating the frequency offset in an OFDM communication system, comprising the steps of:

allocating certain locations in an OFDM frame to a signature sequence;

transmitting said signature sequence with data to a receiver, wherein said data and said signature sequence are encoded using a differential encoding performed in frequency; and

estimating the frequency offset at said receiver by determining whether a correlated peak associated with said signature sequence is in an expected location.

2. The method of claim 1, wherein said signature sequence is stored in the last column of a block interleaver.

3. The method of claim 1, wherein said signature sequence is transmitted over a number of bins in upper and lower side bands of the digital signal.

4. The method of claim 1, further comprising the step of correcting said estimated frequency offset using feedback techniques.

5. The method of claim 1, further comprising the step of correcting said estimated frequency offset using forward error correction techniques.

6. The method of claim 1, wherein said signature sequence is transmitted every L data frames on each side band, where L is generally the number of OFDM frames that can fill the interleaver memory.

7. The method of claim 1, wherein said signature sequence is transmitted every time an interleaver memory is full.

8. The method of claim 1, further comprising the step of delaying the transmission of said signature sequence on one side band from the other side band.

9. The method of claim 1, further comprising the step of maintaining said signature sequence in the center of a search window.

10. The method of claim 1, wherein the signature sequence is a Barker sequence.

11. The method of claim 1, wherein the signature sequence is a Barker sequence with a very low side-lobe.

12. A method for estimating the frequency offset in an OFDM communication system, comprising the steps of:

receiving a digital signal, wherein said received digital signal contains a signature sequence in an expected location, wherein said received digital signal is encoded using a differential encoding performed in frequency;

correlating said received digital signal using a filter matched to said signature sequence; and

identifying whether a correlated peak associated with said received digital signal is an expected location.

13. The method of claim 12, wherein said signature sequence is stored by a transmitter in the last column of a block interleaver.

14. The method of claim 12, wherein said signature sequence is received over a number of bins in upper and lower side bands of the digital signal.

15. The method of claim 12, further comprising the step of correcting said estimated frequency offset using feedback techniques.

16. The method of claim 12, further comprising the step of correcting said estimated frequency offset using forward error correction techniques.

17. The method of claim 12, wherein said signature sequence is received every L data frames on each side band, where L is generally the number of OFDM frames that can fill an interleaver memory.

18. The method of claim 12, wherein said signature sequence is received every time a de-interleaver memory is full.

19. The method of claim 12, wherein the signature sequence on one side band is delayed from the other side band.

20. The method of claim 12, further comprising the step of maintaining said signature sequence in the center of a search window.

21. The method of claim 12, wherein the signature sequence is a Barker sequence with a very low side-lobe.

22. A method for synchronizing interleavers in an OFDM communication system, comprising the steps of:

allocating certain locations in an OFDM frame to a signature sequence;

transmitting said signature sequence with data to a receiver, wherein said data and said signature sequence are encoded using a differential encoding performed in frequency; and

identifying a beginning of an interleaver block based on a location of a correlated peak associated with said signature sequence.

23. The method of claim 22, wherein said signature sequence is stored in the last column of a block interleaver.

24. The method of claim 22, wherein said signature sequence is transmitted over a number of predefined bins in both the upper and lower sides of the digital signal.

25. The method of claim 22, wherein said signature sequence is received every L data frames on each side band, where L is generally the number of OFDM frames that can fill an interleaver memory.

26. The method of claim 22, wherein said signature sequence is transmitted every time an interleaver memory is full.

27. The method of claim 22, further comprising the step of delaying the transmission of said signature sequence on one side band from the other side band.

28. The method of claim 22, wherein the signature sequence is a Barker sequence with a very low side-lobe.

29. A receiver in an OFDM communication system for receiving a digital signal containing a signature sequence in an expected location, comprising:

a filter matched to said signature sequence for correlating said received digital signal, wherein said received digital signal is encoded using a differential encoding performed in frequency; and

a frequency offset estimator that identifies whether a correlated peak associated with said received digital signal is an expected location.

30. A receiver in an OFDM communication system, comprising:

means for receiving a digital signal having a signature sequence in certain locations, wherein said received digital signal is encoded using a differential encoding performed in frequency;

a filter matched to said signature sequence for correlating said received digital signal; and

an interleaver synchronizer that identifies a beginning of an interleaver block based on a location of a correlated peak associated with said signature sequence.

PTO/SB/31 (08-03)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

NOTICE OF APPEAL FROM THE EXAMINER TO THE BOARD OF PATENT APPEALS AND INTEFERENCES

Docket Number (Optional): Sarraf 20-12

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to "Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450"
on September 14, 2004

Signature: Linda M. Shackleton

Typed or printed name: Linda M. Shackleton

In re Application of: Sarraf et al.

Application Number	Filed
09/396,055	September 15, 1999

For: Method and Apparatus For Frequency Offset Estimation And Interleaver Synchronization Using Periodic Signature Sequences

Art Unit	Examiner
2685	Charles Chang Chow

Applicant hereby **appeals** to the Board of Patent Appeals and Interferences from the last decision of the examiner.

The fee for this Notice of Appeal is (37 CFR 1.17(b)) $330.00

☐ Applicant claims small entity status. See 37 CFR 1.27. Therefore, the fee shown above is reduced by half, and the resulting fee is: $ _____

☐ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account. I have enclosed a duplicate copy of this sheet.

☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. 50-0762 . I have enclosed a duplicate copy of this sheet.

☐ A petition for an extension of time under 37 CFR 1.136(a) (PTO/SB/22) is enclosed.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the

☐ applicant/inventor.

☐ assignee of record of the entire interest.
See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed.
(Form PTO/SB/96)

☒ attorney or agent of record.
Registration number 36,597

☐ attorney or agent acting under 37 CFR 1.34(a).
Registration number if acting under 37 CFR 1.34(a). _____

Kevin M. Mason
Signature

Kevin M. Mason
Typed or printed name

203-255-6560
Telephone number

September 14, 2004
Date

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☐ *Total of _____ forms are submitted.